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Lodged (22) 22nd August, 1973

Complete Specification entitled (54) METHOD AND APPARATUS FOR A CONTINUOUS DUMBELL TUBE ANCHORING SYSTEM FOR SUBMARINE PIPELINES

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Related Art (56)

295513 (63602/65)	86.4; 74.5; 92.6
435969 (24113/67)	82.6; 92.6; 74.50
450169 (46084/72)	82.6; 92.6; 74.52; 74.50

The following statement is a full description of this invention, including the best method of performing it known to us :

11746/75-L

F. D. Atkinson, Government Printer, Canberra

X722-82-6D-25P.C.

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This invention relates to the forming and stalling of an anchoring system for submarine pelines beneath a body of water such as on the a floor. There are presently many varied uses submerged conduits or pipelines installed on e sea floor. These include off-shore supply piping loading ships such as slurry carriers for loading tankers and the like and for off-shore gas and well delivery systems. However, various problems ve occurred relative to the installation and maintence of these underwater pipeline systems. Because the natural forces of ocean currents and wave tion which are normally transmitted to the bottom the sea in shallower waters, it is necessary to cure or anchor underwater pipeline systems sufficiently order to prevent scouring or eroding of the pipeline stem by these natural forces.

Systems presently being employed for anchoring derwater pipelines include weighting the pipeline wn with a concrete jacket and utilizing discrete mponents such as anchoring pilings and clamps located spaced locations along the pipeline to prevent teral movement. However, these prior art anchoring stems are vulnerable to the undermining of the a bed caused by the interaction of the natural rrent forces with the pipe such that the bottom terial is eventually eroded away adjacent to the pe, thereby causing scouring of the support means the flowing of water beneath it. A further disadvange of the prior art systems is the necessity for

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the services of divers who must actually work on location on the ocean bottom in order to install these known systems.

Another system for anchoring submerged conduits and pipelines and which comprises a basic improvement over heretofore known systems is disclosed by the Keith U.S. Patent Application Serial No. 273,447, filed July 20, 1972. This latter system comprises a means for anchoring submerged conduits or pipelines wherein an elongated, flexible envelope is partially filled with a non-soluble particulate matter. The structure of the envelope defines a pair of laterally disposed lobes such that the envelope assumes a dumbbell shape in cross-section. The central portion of the envelope comprises a web that is disposed over the conduit so that the lobes of the dumbbell will lie on either side of the submerged pipeline. As such, the particulate matter serves to weigh down or ballast each side of the envelope and causes the web portion to anchor the interposed section of piping. The subject matter of the instant invention comprises an improvement in the form of a method and apparatus for continuously forming and installing the basic anchoring system disclosed by this latter application.

It is ~~therefore an object of the present~~ invention to provide ~~a method and~~ *an* apparatus for forming and installing an anchoring system for submerged conduits or pipelines which will overcome the inherent limitations and disadvantages of the known prior art systems.

It is another object of the present invention °

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to provide an anchoring system for submerged pipelines such that the system will be resistant to the natural forces of ocean currents and wave actions as well as severe weather conditions.

It is still another object of the present invention to provide an anchoring system of the aforementioned character having an effective high weight characteristic and an economical cost per unit length factor.

It is still a further object of the present invention to provide an apparatus for continuously forming and installing an anchoring system of the above character along a submerged conduit or pipeline system.

It is yet another object of the present invention to provide an anchoring system which requires no drilling and placement of anchor pilings as are presently necessary with the known systems.

The invention accordingly provides an apparatus for continuously forming and installing an anchoring system for pipelines which are at least partially supported on the bed of a body of water, comprising in combination a vessel adapted to float on the body of water, a supply of ballast material on the vessel, a supply of tube material on the vessel, envelope forming means on the vessel for forming an elongated tubular envelope from the supply of tube material, installation means carried by the vessel for installing the formed envelope over the pipeline which is supported on the bed, said envelope being installed with its opposite lateral sides defining lobes which are symmetrically positioned on the opposite lateral sides of the pipeline with an adjoining web of the envelope covering the uppermost

portion of the pipeline, distribution means suspended from the vessel into the water for directing ballast material into the lobes of the tubular envelope which is installed over the pipeline, and conveying means for conveying the ballast material from said ballast supply to the distribution means.

These and other objects and features of the instant invention will become apparent from the following description and claims when taken in conjunction

with the accompanying drawings wherein:

Figure 1 is a plan view of a first embodiment of the continuous anchoring system forming apparatus of the present invention.

Figure 2 is a side elevation view of the anchoring system forming apparatus of Figure 1.

Figure 3 is an enlarged fragmentary plan view of the dumbbell tube forming and filling area of the anchor system forming apparatus as viewed on the line 3-3 of Figure 2.

Figure 4 is a side elevation view of the apparatus of Figure 3.

Figure 5 is an enlarged fragmentary horizontal sectional view taken along the line 5-5 of Figure 2.

Figure 6 is a fragmentary side elevational view as seen along the line 6-6 of Figure 5.

Figure 7 is an enlarged fragmentary transverse sectional view taken along the line 7-7 of Figure 5.

Figure 8 is an enlarged transverse sectional view taken along the line 8-8 of Figure 5.

Figure 9 is a plan view of a second embodiment of the apparatus for forming and installing the anchoring system of the present invention.

Figure 10 is a side elevation view of the apparatus of Figure 9.

Figure 11 is an enlarged fragmentary plan view taken along the line 11-11 of Figure 10.

Figure 12 is an enlarged fragmentary elevational

view taken on the line 12-12 of Figure 9.

Figure 13 is a fragmentary side elevation view of the anchoring system being installed by the apparatus of the second embodiment.

Figure 14 is a transverse sectional view taken along the line 14-14 of Figure 13.

Figure 15 is a transverse sectional view taken along the line 15-15 of Figure 13.

Figure 16 is a fragmentary plan view of an alternate form of an anchoring system formed and installed by the apparatus of the second embodiment of Figure 13.

Figure 17 is a transverse sectional view through a portion of the system of Figure 16 which extends upwardly toward the vessel.

Figure 18 is a transverse sectional view taken along the line 18-18 of Figure 16.

Referring to Figs. 1-4 of the drawings, there is depicted an apparatus 1 of the present invention for forming and installing an anchoring system for a submerged submarine pipeline. A sea going vessel 3 which may be in the form of a barge or the like includes a compartment 5 for storing a ballast material 6 utilized in forming the anchoring system. This latter material may comprise any suitable weighty particulate material such as sand, cement or concrete and the like. The preferred ballast material is iron-sand or titaniferous magnetite beach sand.

Secured to the barge 3 is a support framing 7 upon which is supported a roller spool 9 of a substantially flat web material 11 which is used for forming the elongated tubular envelope that contains the ballast

material. The web 11 may be porous and permeable or impermeable, depending upon the type of ballast material 6 being used. Preferably, the material making up the web 11 may be a pourous woven plastic fabric which is resistant to the natural eroding and deteriorating factors of the water environment. The dispensing of the web 11 from roller spool 9 is effected by means of a pair of material feed rollers 13 which are power driven by means of a variable speed motor 15.

The rollers 13 feed the web 11 to an envelope forming means which comprises a tube forming plate 17 and a tube form means 19. The sealing or seaming together of the edges of the web is effected by means of a well-known seaming means 21. This latter device may be in the form of a heating means for joining together the edges of the web 11 if plastic web material is being utilized. Alternatively, seaming means 21 may be in the form of any suitable apparatus for sewing, stapling or cementing the edges of the web 11 together such that a sufficiently strong joint is produced with lasting qualities for the water environment within which it will be ultimately placed.

Disposed coaxially in relationship with the tube form means 19 is a filler hose 23 which is preferably made of flexible material. The end of the filler hose 23 at this point is connected to a ballast fill line 25 which receives the ballast material from a ballast mixing tank 27 which may be provided with a pump (not shown) in its lower section. Ballast

contained within tank 27 is conveyed thereto by means of a feed conveyor 29 which draws from the ballast supply 6 contained within compartment 5.

A formed and sealed tubular envelope 30 is passed downwardly to an ocean floor 31 on top of a submerged pipeline 33. As seen in Fig. 2, the flexible filler hose 23 is contained within the envelope 29 which has been formed therearound. To the end of the filler hose 23 at the ocean floor is secured a bifurcated or "Y"-shaped flexible splitter hose 35. This latter member is depicted in Figs. 5-7 wherein there is shown adjacent the base of the bifurcation of hose 35 a guide roller 37 which is adapted to ride in a guiding manner on top of the submerged pipeline 33. Also connected to the splitter hose 35 is a spreader bar 39 with guide rollers 41 secured thereto for contacting the lateral or side portions of the pipeline 33.

Figure 8 shows the installed anchoring system over the submerged pipeline 33. The tubular envelope 30 containing the ballast material 6 assumes a double-lode dumbbell shape which straddles the pipeline 33 and anchors same to the ocean floor 31.

Referring now to Figs. 9 and 10, there is depicted a second embodiment of an apparatus for forming and installing the anchoring system of the present invention. In this embodiment, a barge or similar sea-going vessel in the form of a ship or the like that is adapted for carrying and laying a plurality of pipe sections 103 which, when joined together, make up

a submerged pipeline 105. The barge 100 is provided with a compartment 107 for containing a ballast material 109. A feed conveyor 111 conveys the ballast material 109 to a ballast mixing tank 113. The latter tank may be provided with a pump (not shown) in its lower section. The ballast material is conveyed through a ballast fill line 115 to a bifurcated hose 137. ~~filler hose 117.~~

The forming of the envelope portion of the anchor system by the apparatus of this second embodiment is shown in Figs. 11 and 12. A roller spool 119 stores a roll of a substantially flat web material 121 utilized for forming an envelope 123 for containing the ballast material 109. The web 121 is dispensed from spool 119 by means of a pair of feed rollers 125 driven by a variable speed motor 127. The web 121 then passes around a tube forming plate 129 and is curved by a tube form means 131. A sealing or seaming means 133 is disposed above the tube form means 131 for seaming the edges of the web 121 together to form the envelope 123 in the same basic manner as outlined above for the first embodiment. As is evident in Figs. 11 and 12, the pipe sections 103 making up the submerged pipeline 105 are joined together and passed through a framework 135 supporting the web supply spool 119, tube form means 131 and seaming means 133. As seen in Fig. 12, the completed envelope 123 containing the filler hose 137 ~~117~~ is draped over the joined pipe sections 103 being advanced to the ocean floor to form the submerged pipeline.

The bifurcated or Y-shaped splitter hose 137 which reaches ~~other end of the filler hose 117 reaching~~

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to the ocean floor is shown in Figs. 13 to 15. As in the case of the first embodiment, the splatter hose 137 is provided with a brace or spreader bar 139 having attached thereto a guide roller 141 for guiding contact with the upper portion of the submerged pipeline 105.

Figs. 16, 17 and 18 show an alternate form of filling the envelope 123' by the apparatus of the second embodiment. As seen in Fig. 17, the envelope 123' completely encloses the joined pipe sections 103' as they are being layed to form the submerged pipeline 105'. Also enclosed within the envelope 123' is a single ballast fill line 117' that is supported by a bracing means 145 having a guide roller 141' associated therewith. By virtue of this alternate arrangement when in only a single fill line 117' is employed, the resulting anchoring system, as shown by Fig. 18, completely encloses the submerged pipeline 105'.

The basic mode of operation for the continuous forming and installing of the anchoring system of the present invention is basically the same for the two embodiments of the apparatus discussed above. The main difference being in the simultaneous laying of both the pipe and the anchoring system by the second embodiment whereas the first embodiment lays the anchoring system over the already submerged pipeline.

The system is initiated by drawing the web material from its supply spool by means of power driven feed rollers. The webbing is then passed around a tube forming plate and a tube form means wherein it is bent into a basic tubular envelope shape. The edges of the envelope are then sealed. The end of the envelope thus formed is clamped shut and pulled along the outside of the splitter section of the filler hose. The end of the envelope is then pulled forward a short distance for initial filling on its bottom in order to establish the necessary weight for placement over the submerged pipeline. The ballast material is then conveyed from the storage compartment to the mixing tank and through the fill line to the filler hose. As the ballast material is ejected

out the bifurcated legs of the splitted hose, the latter is pulled through the continuously forming envelope by means of guide rollers contacting the top and side portions of the submerged pipeline. The envelope being draped over the submerged pipeline will fill with ballast material thereby forming two lobe sections having the shape of a dumbbell. The top section of the envelope is essentially in the form of a web which, by virtue of the weight of the ballast material contained in the lateral lobe sections, serves to weigh or anchor the submerged pipeline down upon the ocean floor.

In general, the ballast can be loaded into the tube in either a dry or wet state. Preferably, however, the ballast material is mixed with water to form a slurry and is transported in slurry form to the sea bottom, that is to say, to the end of the splitted hose. At its location of interjection, the ballast settles and is retained by the dumbbell tube, however, the supporting water flows out to the permeable fabric of the tube and through the holes between the tube fibers. In general, the fiber spacing of the material of which the tube is made is close enough to retain ballast, but allows the water to pass away.

While various particular structures are shown in illustrating thepreferred embodiments of the present invention, it would be understood that many modifications and adaptations of the invention will occur to those skilled in the art to which it is directed. For example, the rollers in variable speed motor used

for feeding the tube may or may not be necessary once operation has been started since the dumbbell tube will be held on the sea bottom by its own weight and, as the dispensing barge advances, the additional tubing will be pulled off the feed roll without the necessity for the assistance of the variable speed drive mechanism. Accordingly, the invention as disclosed in here should be taken in a general sense as including such departures from the present disclosure as come within knowledge or customary practice in the art to which the invention pertains, and as may be applied to the essential features hereinbefore set forth and fall within the scope of the invention or the limits of the appended claims.

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THE CLAIMS DEFI[illegible] THE INVENTION ARE AS FOLL[illegible]

1. An apparatus for continuously fo[illegible]ng and installing an anchoring system for pipelines which are at least partially supported on the bed of a body of water, comprising in combination a vessel adapted to float on the body of water, a supply of ballast material on the vessel, a supply of tube material on the vessel, envelope forming means on the vessel for forming an elongated tubular envelope from the supply of tube material, installation means carried by the vessel for installing the formed envelope over the pipeline which is supported on the bed, said envelope being installed with its opposite lateral sides defining lobes which are symmetrically positioned on the opposite lateral sides of the pipeline with an adjoining web of the envelope covering the uppermost portion of the pipeline, distribution means suspended from the vessel into the water for directing ballast material into the lobes of the tubular envelope which is installed over the pipeline, and conveying means for conveying the ballast material from said ballast supply to the distribution means.

2. The apparatus of claim 1 wherein the envelope forming means includes tube form means for forming an elongate tube from the supply of tube material, and seaming means for seaming the tube formed by the tube form means.

3. The apparatus of claim 1 wherein the distribution means includes a filler hose having one end connected with the conveying means for receiving the ballast material, and a splitter hose having an inlet connected to the other end of the filler hose and having bifurcated outlets disposed on opposite lateral sides of the pipeline supported on the bed whereby said outlets distribute the ballast material into said lobes of the tubular envelope.

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4. The apparatus of claim 3 which includes a first roller carried by the splitter hose and mounted for guiding movement along the uppermost portion of the pipeline supported on the bed, and a plurality of second rollers carried by the splitter hose and mounted for guiding movement along the side portions of the pipeline supported on the bed.

5. The apparatus of claim 1 wherein the supply of tube material includes roller spool means for storing and dispensing a roll of said tube material, and power-operated feed means for feeding the tube material from the roller spool means to the envelope forming means.

6. The apparatus of claim 1 wherein the conveying means includes a ballast mixing tank carried by the vessel, a feed conveyer for conveying ballast material from said ballast supply to the ballast mixing tank, and a ballast fill line for conveying the ballast from the mixing tank to the distribution means.

7. An apparatus for continuously forming and installing an anchoring system for pipelines which are at least partially supported on the bed of a body of water, the apparatus being substantially as hereinbefore described with reference to the accompanying drawings.

Dated this 2nd day of June, 1975.

MARCONA CORPORATION
By its Patent Attorneys
DAVIES & COLLISON

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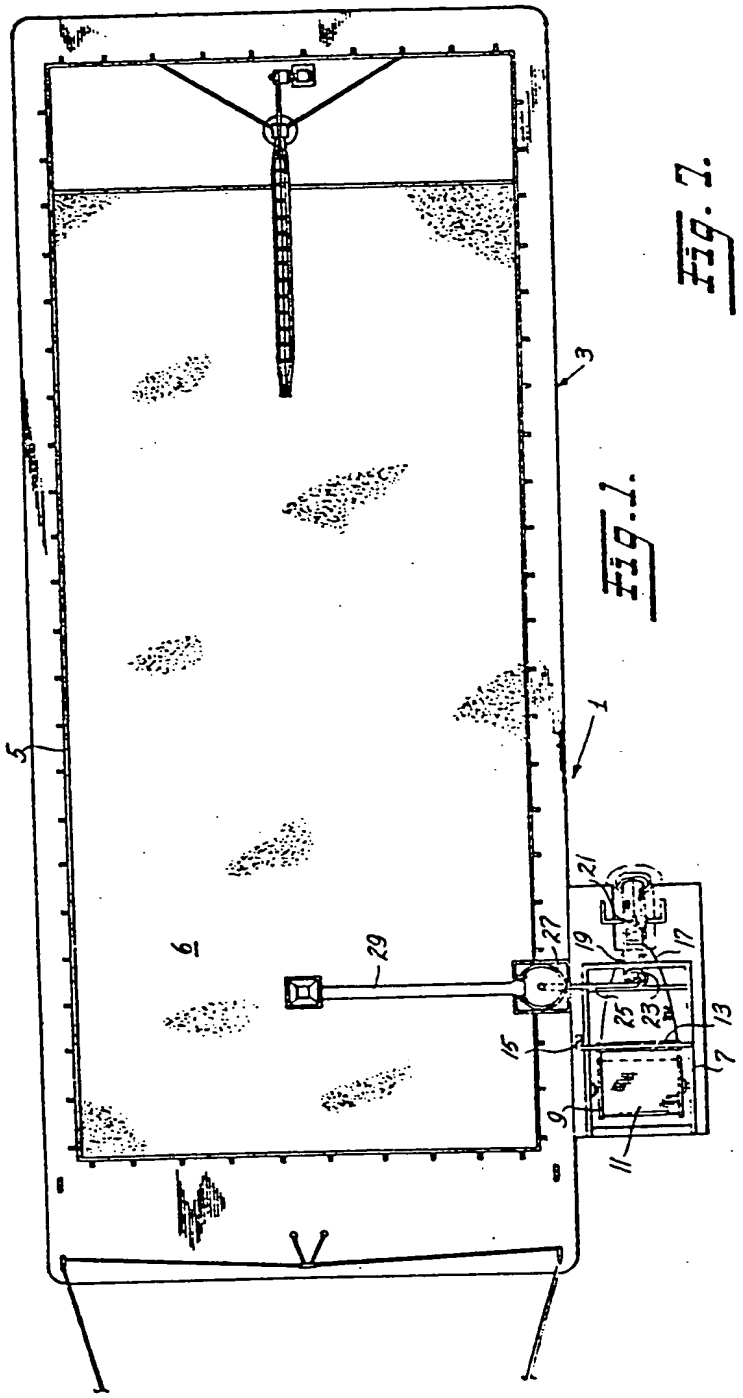

Fig. 1.

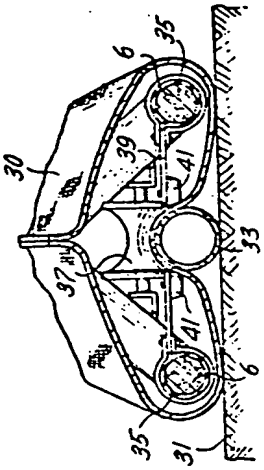

Fig. 7.

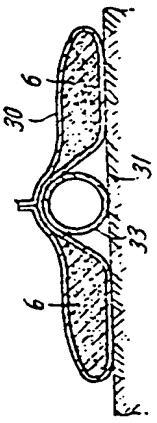

Fig. 8.

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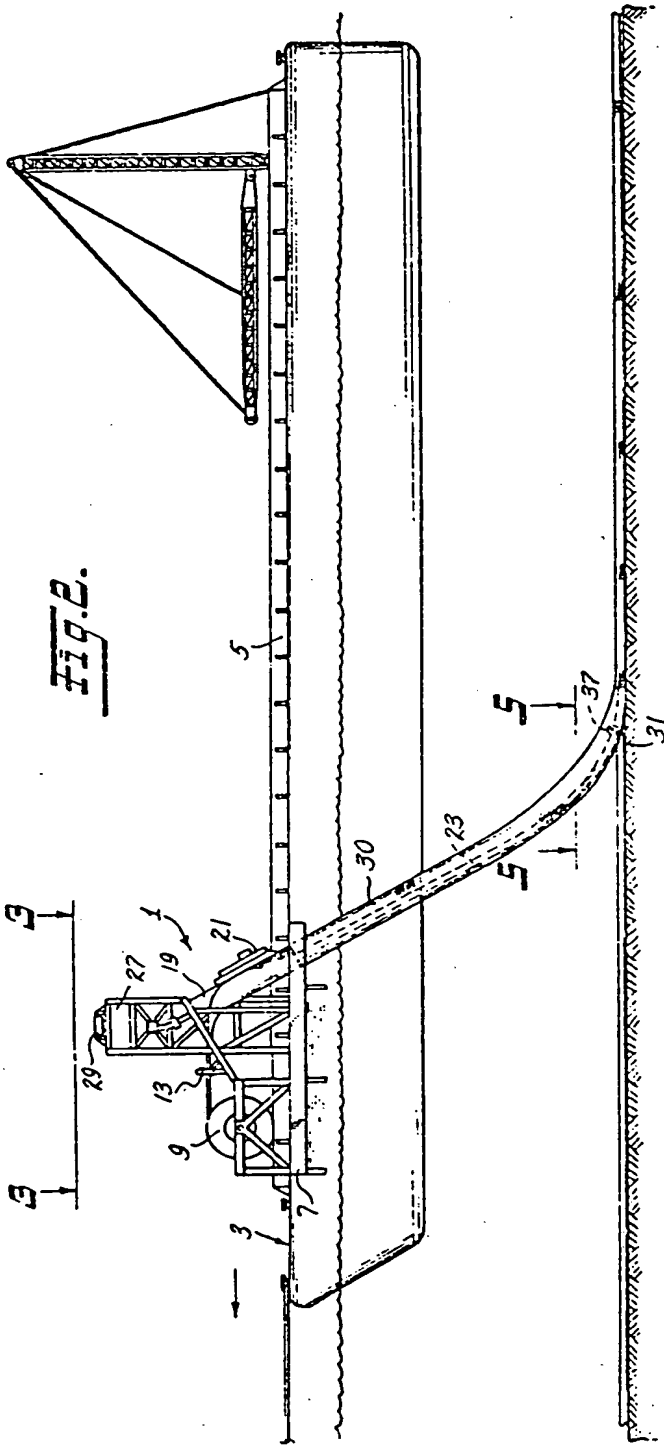

Fig.2.

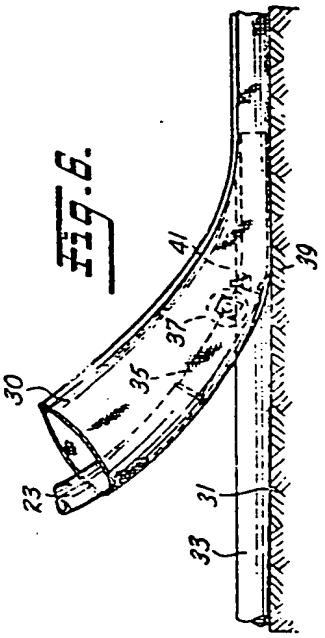

Fig.6.

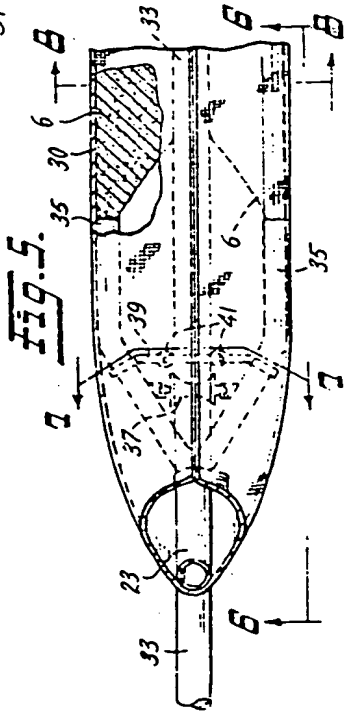

Fig.5.

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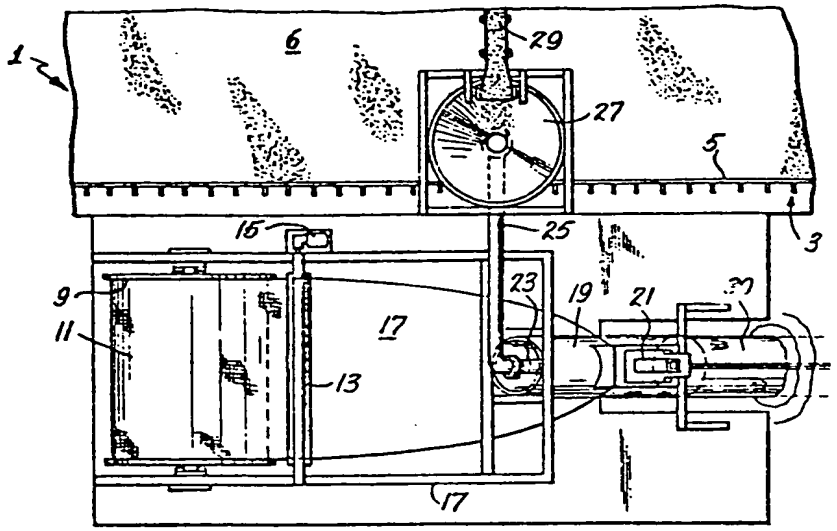

Fig. 3.

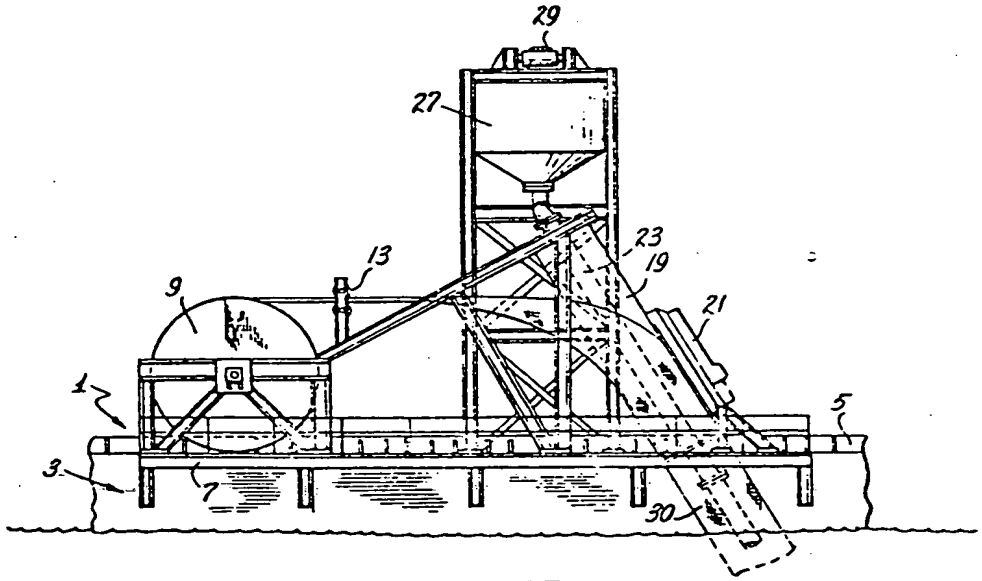

Fig. 4.

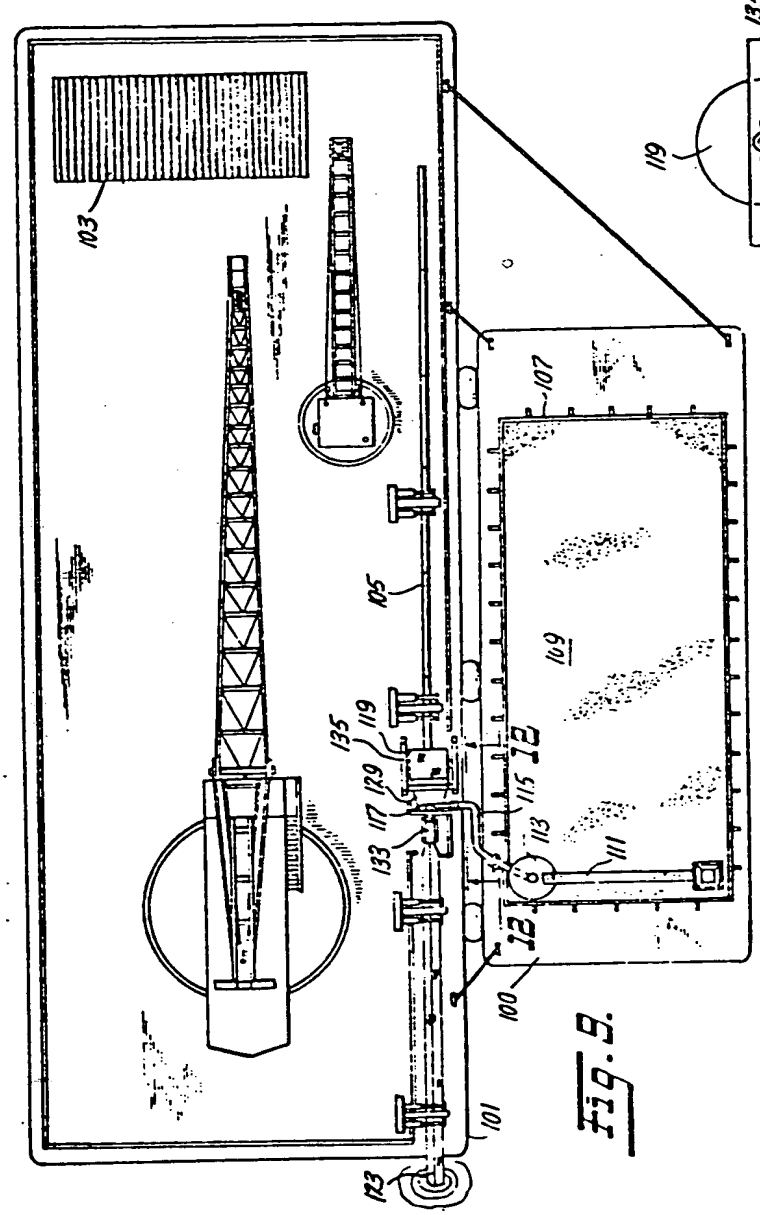
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Fig. 9.

Fig. 12.

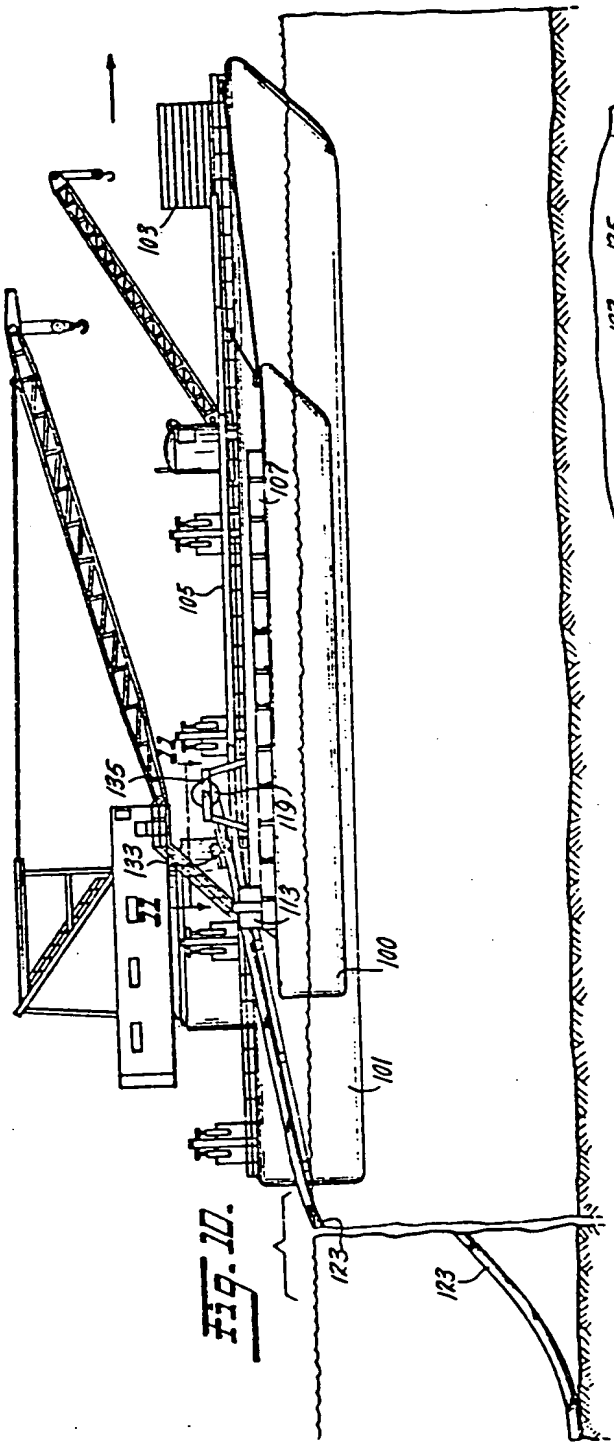
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Fig. 10.

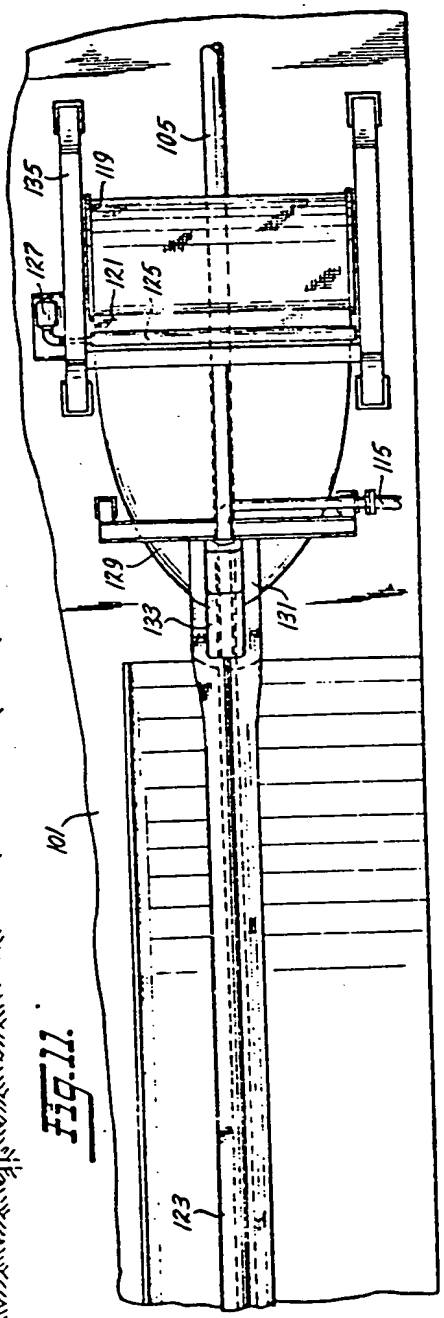
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Fig. 11.

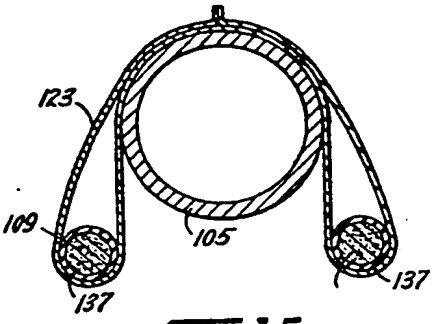

Fig.15.

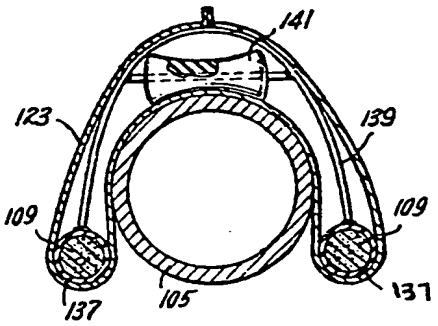

Fig.14.

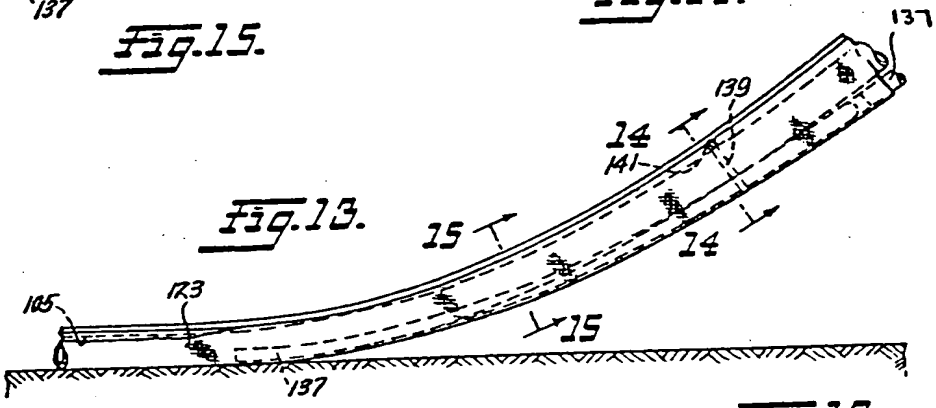

Fig.13.

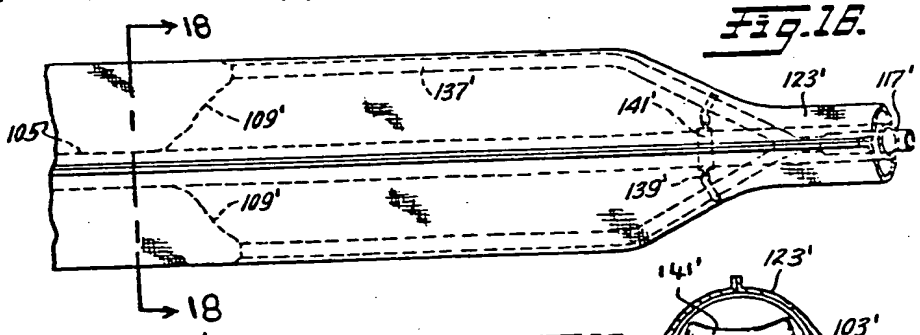

Fig.16.

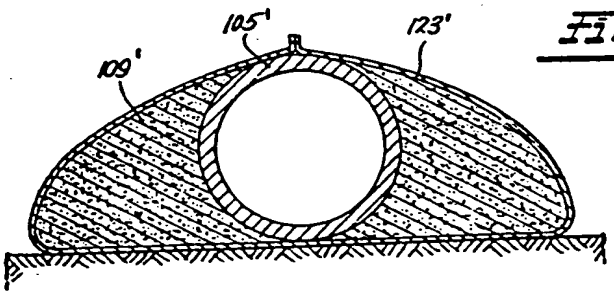

Fig.18.

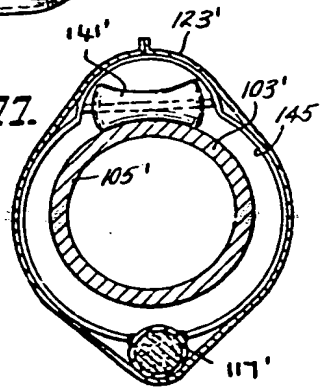

Fig.17.

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